OIPE IAP79
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PTO/SB/21 (04-04)
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TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	10/633,334
Filing Date	08/01/2003
First Named Inventor	Maxwell W. Lippitt III, et al
Art Unit	2823
Examiner Name	Brewster, William M.
Attorney Docket Number	Buckfeller 13-2-2-3/075903-149

Total Number of Pages in This Submission

ENCLOSURES *(Check all that apply)*

- [x] Fee Transmittal Form
- [x] Fee Attached
- [ ] Amendment/Reply
- [ ] After Final
- [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Response to Missing Parts/ Incomplete Application
- [ ] Response to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) _____
- [ ] After Allowance communication to Technology Center (TC)
- [ ] Appeal Communication to Board of Appeals and Interferences
- [x] Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- [ ] Proprietary Information
- [ ] Status Letter
- [x] Other Enclosure(s) (please Identify below):

1. Postcard.

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm or Individual name	John L. DeAngelis, Jr., Reg. No. 30,622 Beusse Brownlee Wolter Mora & Maire, P.A.
Signature	
Date	September 14, 2005

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below.

Typed or printed name	Pamela A. Pagel		
Signature		Date	09/14/2005

This collection of information is required by 37 CFR 1.5. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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OIPE IAP79 SEP 16 2005 PATENT & TRADEMARK OFFICE

PTO/SB/17 (12-04v2)
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Effective on 12/08/2004.
Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL
For FY 2005

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT	($) 500.00

Complete if Known	
Application Number	10/633,334
Filing Date	08/01/2003
First Named Inventor	Maxwell W. Lippitt III
Examiner Name	Brewster, William M.
Art Unit	2823
Attorney Docket No.	Buckfeller 13-2-2-3/075903-149

METHOD OF PAYMENT (check all that apply)

☑ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): _____

☐ Deposit Account Deposit Account Number: _____ Deposit Account Name: _____

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☐ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, **except for the filing fee**

☐ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17 ☐ Credit any overpayments

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FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

Application Type	FILING FEES Fee ($)	FILING FEES Small Entity Fee ($)	SEARCH FEES Fee ($)	SEARCH FEES Small Entity Fee ($)	EXAMINATION FEES Fee ($)	EXAMINATION FEES Small Entity Fee ($)	Fees Paid ($)
Utility	300	150	500	250	200	100	
Design	200	100	100	50	130	65	
Plant	200	100	300	150	160	80	
Reissue	300	150	500	250	600	300	
Provisional	200	100	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee ($)	Small Entity Fee ($)
Each claim over 20 (including Reissues)	50	25
Each independent claim over 3 (including Reissues)	200	100
Multiple dependent claims	360	180

Total Claims		Extra Claims		Fee ($)		Fee Paid ($)
_____	- 20 or HP =	_____	x	_____	=	_____

HP = highest number of total claims paid for, if greater than 20.

Indep. Claims		Extra Claims		Fee ($)		Fee Paid ($)
_____	- 3 or HP =	_____	x	_____	=	_____

HP = highest number of independent claims paid for, if greater than 3.

Multiple Dependent Claims Fee ($)	Fee Paid ($)
_____	_____

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets		Extra Sheets		Number of each additional 50 or fraction thereof		Fee ($)		Fee Paid ($)
_____	- 100 =	_____	/ 50 =	_____	(round **up** to a whole number) x	_____	=	_____

4. OTHER FEE(S)

	Fees Paid ($)
Non-English Specification, $130 fee (no small entity discount)	
Other (e.g., late filing surcharge): Appeal Brief fee	$ 500.00

SUBMITTED BY

Signature		Registration No. (Attorney/Agent) 30,622	Telephone (407) 926-7710
Name (Print/Type)	John L. DeAngelis, Jr.		Date 09/14/2005

This collection of information is required by 37 CFR 1.136. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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OIPE IAP79 SEP 16 2005 PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	
Applicants:	Lippitt, III, et al
Examiner:	Brewster, William M.
Serial No.:	10/633,334
Filed:	08/01/2003
Art Unit:	2823
Attorney Docket:	Buckfeller 13-2-2-3/075903-149
Confirmation No.:	4192

For: Temperature Optimization of a Physical Vapor Deposition Process

Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPELLANT'S BRIEF UNDER 37 CFR 41.10

This brief is in furtherance of the Notice of Appeal filed in this application on July 11, 2005 and received by the United States Patent and Trademark Office on July 14, 2005.

The fee set forth in 37 CFR 41.20(b)(2) is paid concurrently with the filing of this brief by check made payable to the Director of USPTO as set forth in the accompanying Transmittal of Appeal Brief.

09/19/2005 WABDELR1 00000011 10633334 500.00 OP
01 FC:1402

1. REAL PARTY IN INTEREST - 37 CFR 41.37(c)(1)(i)

The real party in interest in this Appeal is the assignee of the present application, Agere Systems Inc., a corporation of the State of Delaware.

2. RELATED APPEALS AND INTERFERENCES - 37 CFR 41.37(c)(1)(ii)

There is no other appeal, interference or judicial proceeding that is related to, that will directly affect, that will be directly affected by or that will have a bearing on the Board's decision in this Appeal.

3. STATUS OF CLAIMS - 37 CFR 41.37(c)(1)(iii)

Claims cancelled: none

Claims withdrawn but not cancelled: none

Claims pending: 1-30

Claims allowed: none

Claims rejected: 1-30

Claim rejections appealed: 1-30.

4. STATUS OF AMENDMENTS - 37 CFR 41.37(c)(1)(iv)

After the final rejection in the Office Action mailed on March 9, 2005, the Appellants concurrently filed on July 11, 2005 a Request for Reconsideration under Section 1.116 and a Notice of Appeal. As of this date, Appellants have not received a response to the Request for Reconsideration.

5. SUMMARY OF CLAIMED SUBJECT MATTER- 37 CFR 41.37(c)(1)(v)

The present invention relates generally to temperature optimized physical vapor deposition processes.

During formation of integrated circuit interconnect structures, a process referred to as metallization, successive substantially parallel layers of conductive material and dielectric material are alternately formed over an upper surface of an integrated circuit substrate. Substantially vertical openings or vias are formed in the dielectric layers and filled with

conductive material to electrically connect an overlying and an underlying conductive material layer. See the sequential process steps illustrated in Figures 1-10 of the application as filed.

Figure 12 of the application illustrates a tungsten plug 130 within a window or via opening 131 for interconnecting overlying and underlying aluminum metallization layers 132 and 134, respectively. Figure 12 also illustrates a titanium layer 148 and a titanium-nitride layer 150 that are formed in the opening 131 by sputter deposition from a target material prior to formation of the tungsten plug 130. The layers 148 and 150 provide beneficial adhesion and barrier properties for the later-deposited tungsten.

According to the prior art, during sputter deposition of the titanium and titanium-nitride from the target into the opening, aluminum in the underlying aluminum metallization layer extrudes upwardly within the via opening. Figure 16A illustrates an aluminum mass 216 that has begun to extrude upwardly in the via opening 210, leaving behind voids 217 in the aluminum metallization layer 214. In Figure 16B the aluminum mass 216 has extruded out of the via opening 210 and formed a mass on an upper surface 218 of the dielectric substrate 212.

The Appellants have determined that the aluminum transitions to a plastic deformation state and begins to extrude from the via at a wafer temperature in excess of about 410 °C. Bombardment of the wafer by the sputtered ions as they deposit in the via opening, coupled with the stress forces imposed on the aluminum layer by the overlying material layers, cause the wafer to reach this temperature.

The present invention prevents the aluminum extrusion by increasing a power supplied to the target from which the material is sputtered. The higher power produces a more intense electric field in a region around the target, increasing the velocity at which ions strike the target and release the target material for sputtering onto the wafer. As a result of the increased target power more target atoms are sputtered from the target over a fixed time interval than are sputtered at the lower power level of the prior art. That is, the sputtered target material density is higher in response to the higher target power. The higher target material density accelerates the deposition rate of the target ions on the wafer compared with the prior art process. The increased deposition rate (about 50% faster in one embodiment)

shortens the deposition duration and thus the wafer temperature does not have sufficient time to reach the critical temperature at which the aluminum extrusion begins.

Increasing the power as taught by the present invention is a counter-intuitive approach, as the prior art discloses lowering the target power to lower the velocity of ions that impinge the target and release the target material for sputter deposition onto the wafer. However, the Appellants recognize that lower velocity impinging ions striking the target release fewer target atoms and thus fewer sputtered target ions strike the wafer during a given time interval, protracting the deposition period. The Appellants further recognize that the resulting longer deposition period allows the wafer temperature to increase to a temperature where aluminum begins to extrude from the openings.

The present invention teaches raising the target power to increase the velocity of the ions striking the target, in turn increasing the density of the material sputtered from the target and thus accelerating the target material deposition rate. According to the invention, the sputter deposition process is completed before the wafer temperature reaches a temperature at which the aluminum transitions to a plastic deformation state and begins to extrude from the openings.

6. GROUNDS OF REJECTION TO BE REVIEWED UPON APPEAL -

37 CFR 41.37(c)(1)(vi)

A) Claims 1-12, 14-16, 18 and 25-28 are rejected as unpatentable under 35 U.S.C. 102(e) as anticipated by Chen (U.S. 6,660,622 B2).

B) Claims 19-24 are rejected as unpatentable under 35 U.S.C. 102(b) as anticipated by Gopalraja (U.S. 6,193,855 B1).

C) Claims 13, 17, 29 and 30 are rejected as unpatentable under 35 U.S.C. 103(a) over Chen as applied to claims 1-12, 14-16, 18 and 25-28 above and further in view of Gopalraja.

7. APPENDICES

A copy of claims 1-30 involved in this appeal is attached as a claims appendix under 37 CFR 41.37(c)(1)(viii). There is no evidence to supply in conjunction with the evidence

appendix under 37 CFR 41.37(c)(1)(xi) or any related proceedings information to supply as a related proceedings appendix under 37 CFR 41.37(c)(1)(x).

8. ARGUMENT 37 CFR 41.37(c)(1)(vii)

A) The Appellants traverse the rejection of claims 1-12, 14-16, 18 and 25-28 under 35 U.S.C. 102(e) as unpatentable over Chen (U.S. 6,660,622 B2).

Chen does not support a *prima facie* case of anticipation for claims 1-12, 14-16, 18 and 25-28 because Chen fails to disclose each of the claimed elements. In particular, Chen does not suggest, "controlling the power supplied to the target to maintain the wafer temperature below a critical temperature." Neither the word "temperature" nor the word "extrude" appears in Chen.

With regard to the rejections applied against claims 1-12, 14-16, 18 and 25-28 these rejected claims do not stand or fall together because each claim defines a unique combination that patentably distinguishes over the art of record and each should therefore be separately considered.

A.1) Claim 1:

Independent claim 1 is directed to a method for depositing a target material on a semiconductor wafer.

The test for establishing a *prima facie* case of anticipation under §102 "requires the presence in a single prior art reference of each and every element of the claimed invention, arranged as in the claim." (*Lindemann Maschinenfabrik GMbH v. American Hoist and Derrick Co.*, 730 F.2d 1452, 221 USPQ 481,485 (Fed. Cir. 1984)). Furthermore, "there must be no difference between the claimed invention and the referenced disclosure, as viewed by a person of ordinary skill in the field of the invention." *Scripps Clinic and Research Found. v. Genentech Inc.*, 927 F.2d 1565, 18 USPQ2d 1001, 1010 (Fed. Cir. 1991)). The absence of any claim element and/or operational interrelationship from the reference disclosure negates anticipation under §102.

In the Examiner's rejection of claim 1, the Examiner specifically references Chen's Table 1 to support the Examiner's argument that the Appellants' controlling power step of

claim 1 is disclosed. The Examiner further states that the patent laws do not require patent applicants to disclose every underlying scientific principle, feature or problem avoided.

Table 1 discloses process conditions for a two step process. In step one "the IMP chamber is being operated in a wafer pre-clean mode" with a target power of 0 kW. In step two the chamber is being operated "in an ionized sputter deposition mode" with a target power of 1 kW.

Chen discloses a process for, "removing a barrier layer formed at the bottom of a via by a sputter etching process performed in a plasma sputter deposition chamber [step 1]. The same sputter deposition chamber may be advantageously used to then deposit a second barrier layer [step 2]." The two steps of sputtering the wafer to remove the barrier layer and the sputtering step to deposit the second barrier layer are, "differentiated by power applied to the target, by chamber pressure, or by wafer bias." Chen further states at column 4, beginning at line 64, "[in step 1] the IMP chamber allows the formation of an argon plasma without sputtering the tantalum target by exciting the plasma through the inductive coil and not significantly DC biasing the target. The highly directional high-energy argon ions incident on the wafer remove or sputter the CVD barrier bottom and field portions 32, 36. That is, a sputtering process is performed on the wafer, not a sputter deposition process."

Chen's two-step process parameters as specified in Table 1 are far below that required to "control[ling] power supplied to the target to maintain the wafer temperature below a critical temperature, wherein at a wafer temperature above the critical temperature the material of the first material layer can extrude into one or more of the plurality of openings."

The Appellant's claim 1 step of "controlling power supplied to the target to maintain the wafer temperature below a critical temperature, wherein at a wafer temperature above the critical temperature the material of the first material layer can extrude into one or more of the plurality of openings" is materially different and patentably distinct from Chen's process of increasing the power level from a first value during a process pre-clean step to a second value during a sputter deposition step.

In his final Office Action, the Examiner advises that it is his duty to interpret the claims as broadly as reasonably possible, citing, *In re Pratter*, 415 F.2d 1393, 1404-05, 162

USPQ 541, 550-51 (CCPA 1969), *In re Morris*, 127 F.3d 1048, 1054-55, 44 USPQ2d 1023, 1027-28 (Fed. Cir. 1997), and *In re Zletz*, 13 USPQ 2d. 1320 (Fed. Cir. 1989). The Appellants suggest, however, that broad claim interpretation during the examination process is not a substitute for applying relevant art that discloses or renders obvious an invention as set forth in a patent claim.

The fact that a certain result or characteristic may occur or be present in the prior art, such as Chen, is not sufficient to establish the inherency of that result or characteristic. *In re Rijckaert*, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993). In this case the CAFC reversed the Examiner's rejection because inherency was based on what would result due to optimization of conditions, not what was necessarily present in the prior art.

"To establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.' "*In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999).

The Examiner has not met his burden of showing that Chen inherently discloses the Appellants' invention as set forth in claim 1. The Examiner cannot merely suggest that certain conditions within the ambit of the Appellants' claim 1 are inherent in Chen and thus Chen anticipates claim 1. To suggest anticipation on that basis requires one to read more into the Chen reference than it discloses, either directly or inherently.

Thus, the rejection of claim 1 under Section 102(e) is not supported by the cited art and should be withdrawn since the Chen process does not disclose the Appellants' invention as set forth in claim 1 either directly or inherently.

A.2) Claim 2:

Claim 2 depends directly from claim 1 and includes the additional limitation of the step of controlling power supplied to the wafer comprises increasing the power supplied to the target to increase a deposition rate of target material particles on the wafer above a

deposition rate at which the first material layer can extrude into one or more of the plurality of openings.

The arguments presented above with respect to the patentability of claim 1 apply to the patentability of claim 2 depending therefrom. Further claim 2 includes the additional limitation set forth above. Thus, the rejection of claim 2 under Section 102(e) is not supported by the cited art and should be withdrawn, since the Chen process does not disclose the Appellants' invention as set forth in claim 2 either directly or inherently.

A.3) Claim 3:

Claim 3 depends directly from claim 1 and includes the additional limitation of the material comprising the target is selected from between titanium and tantalum.

The arguments presented above with respect to the patentability of claim 1 apply to the patentability of claim 3 depending therefrom. Further claim 3 includes the additional limitation set forth above. Thus, the rejection of claim 3 under Section 102(e) is not supported by the cited art and should be withdrawn, since the Chen process does not disclose the Appellants' invention as set forth in claim 3 either directly or inherently.

A.4) Claim 4:

Claim 4 depends directly from claim 1 and includes the additional limitation of one or more of the plurality of openings comprise high aspect ratio openings.

The arguments presented above with respect to the patentability of claim 1 apply to the patentability of claim 4 depending therefrom. Further claim 4 includes the additional limitation set forth above. Thus, the rejection of claim 4 under Section 102(e) is not supported by the cited art and should be withdrawn, since the Chen process does not disclose the Appellants' invention as set forth in claim 4 either directly or inherently.

A.5) Claim 5:

Independent claim 5 is directed to a method for depositing a target material on a semiconductor wafer.

The test for establishing a *prima facie* case of anticipation under §102 "requires the presence in a single prior art reference of each and every element of the claimed invention, arranged as in the claim." (*Lindemann Maschinenfabrik GMbH v. American Hoist and Derrick Co.*, 730 F.2d 1452, 221 USPQ 481,485 (Fed. Cir. 1984)). Furthermore, "there must be no difference between the claimed invention and the referenced disclosure, as viewed by a person of ordinary skill in the field of the invention." *Scripps Clinic and Research Found. v. Genentech Inc.*, 927 F.2d 1565, 18 USPQ2d 1001, 1010 (Fed. Cir. 1991)). Absence from the reference disclosure of any claim element and/or operational interrelationship negates anticipation under §102.

In the Examiner's rejection of claim 5, the Examiner specifically references Chen's Table 1 to support the Examiner's argument that the Appellants' controlling power step of claim 5 is disclosed. The Examiner further states that the patent laws do not require patent applicants to disclose every underlying scientific principle, feature or problem avoided.

Table 1 discloses process conditions for a two step process. In step one "the IMP chamber is being operated in a wafer pre-clean mode" with a target power of 0 kW. In step two the chamber is being operated "in an ionized sputter deposition mode" with a target power of 1 kW.

Chen discloses a process for, "removing a barrier layer formed at the bottom of a via by a sputter etching process performed in a plasma sputter deposition chamber [step 1]. The same sputter deposition chamber may be advantageously used to then deposit a second barrier layer [step 2]." The two steps of sputtering the wafer to remove the barrier layer and the sputtering step to deposit the second barrier layer are, "differentiated by power applied to the target, by chamber pressure, or by wafer bias." Chen further states at column 4, beginning at line 64, "[in step 1] the IMP chamber allows the formation of an argon plasma without sputtering the tantalum target by exciting the plasma through the inductive coil and not significantly DC biasing the target. The highly directional high-energy argon ions incident on the wafer remove or sputter the CVD barrier bottom and field portions 32, 36. That is, a sputtering process is performed on the wafer, not a sputter deposition process."

The Chen process is further described by the parameters set forth in Table 1. These values are far below that required to "control[ling] power supplied to the target to maintain

the wafer temperature below a critical temperature, wherein at a wafer temperature above the critical temperature the material of the first material layer can extrude into one or more of the plurality of openings."

Further, the Appellant's claim 5 step of "supplying power to the target to maintain the wafer temperature below a critical temperature, wherein at a wafer temperature above the critical temperature the material of the first material layer can extrude into one or more of the plurality of openings," is materially different and patentably distinct from Chen's process of increasing the power level from a first value during a process pre-clean step to a second value during a sputter deposition step.

In his final Office Action, the Examiner advises that it is his duty to interpret the claims as broadly as reasonably possible, citing, *In re Pratter*, 415 F.2d 1393, 1404-05, 162 USPQ 541, 550-51 (CCPA 1969), *In re Morris*, 127 F.3d 1048, 1054-55, 44 USPQ2d 1023, 1027-28 (Fed. Cir. 1997), and *In re Zletz*, 13 USPQ 2d. 1320 (Fed. Cir. 1989). The Appellants suggest, however, that broad claim interpretation during the examination process is not a substitute for applying relevant art that discloses or renders obvious an invention as set forth in a patent claim.

The fact that a certain result or characteristic may occur or be present in the prior art, such as Chen, is not sufficient to establish the inherency of that result or characteristic. *In re Rijckaert*, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993). In this case the CAFC reversed the Examiner's rejection because inherency was based on what would result due to optimization of conditions, not what was necessarily present in the prior art.

"To establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.' "*In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999).

The Examiner has not met his burden of showing that Chen inherently disclose the Appellants' invention as set forth in claim 5. The Examiner cannot merely suggest that certain conditions within the ambit of the Appellant's claim 5 are inherent in Chen and thus

Chen anticipates claim 5. To suggest anticipation on that basis requires one to read more into the Chen reference than it discloses, either directly or inherently.

Thus, the rejection of claim 5 under Section 102(e) is not supported by the cited art and should be withdrawn since the Chen process does not disclose the Appellants' invention as set forth in claim 1 either directly or inherently.

A.6) Claim 6:

Claim 6 depends directly from claim 5 and includes the additional limitation of the step of supplying power to the target further comprises increasing the power supplied to the target to increase a deposition rate of ionized target material particles on the wafer, above a deposition rate at which the first material layer can extrude into the plurality of openings.

The arguments presented above with respect to the patentability of claim 5 apply to the patentability of claim 6 depending therefrom. Further claim 6 includes the additional limitation set forth above. Thus, the rejection of claim 6 under Section 102(e) is not supported by the cited art and should be withdrawn since the Chen process does not disclose the Appellants' invention as set forth in claim 6 either directly or inherently.

A.7) Claim 7:

Claim 7 depends directly from claim 5 and includes the additional limitation of the step of supplying power to the target further comprises increasing the power supplied to the target to increase a density of the impinging particles.

The arguments presented above with respect to the patentability of claim 5 apply to the patentability of claim 7 depending therefrom. Further claim 7 includes the additional limitation set forth above. Thus, the rejection of claim 7 under Section 102(e) is not supported by the cited art and should be withdrawn since the Chen process does not disclose the Appellants' invention as set forth in claim 7 either directly or inherently.

A.8) Claim 8:

Claim 8 depends directly from claim 5 and includes the additional limitation of the material comprising the target is selected from between titanium and tantalum.

The arguments presented above with respect to the patentability of claim 5 apply to the patentability of claim 8 depending therefrom. Further claim 8 includes the additional limitation set forth above. Thus, the rejection of claim 8 under Section 102(e) is not supported by the cited art and should be withdrawn since the Chen process does not disclose the Appellants' invention as set forth in claim 8 either directly or inherently.

A.9) Claim 9:

Claim 9 depends directly from claim 5 and includes the additional limitation of the particles impinging the target comprise argon ions.

The arguments presented above with respect to the patentability of claim 5 apply to the patentability of claim 9 depending therefrom. Further claim 9 includes the additional limitation set forth above. Thus, the rejection of claim 9 under Section 102(e) is not supported by the cited art and should be withdrawn since the Chen process does not disclose the Appellants' invention as set forth in claim 9 either directly or inherently.

A.10) Claim 10:

Claim 10 depends indirectly from claim 5 and directly from claim 9 and includes the additional limitation as set forth above for claim 9 and further the limitation of the step of supplying power to the target further comprises increasing the power supplied to the target to increase a velocity of the argon ions.

The arguments presented above with respect to the patentability of claims 5 and 9 apply to the patentability of claim 10 depending therefrom. Further claim 10 includes the additional limitation set forth above. Thus, the rejection of claim 10 under Section 102(e) is not supported by the cited art and should be withdrawn since the Chen process does not disclose the Appellants' invention as set forth in claim 10 either directly or inherently.

A.11) Claim 11:

Claim 11 depends indirectly from claim 5 and directly from claim 9 and includes the additional limitation as set forth above for claim 9 and further the limitation of the step of

supplying power to the target further comprises increasing the power supplied to the target to increase a density of the argon ions.

The arguments presented above with respect to the patentability of claims 5 and 9 apply to the patentability of claim 11 depending therefrom. Further claim 11 includes the additional limitation set forth above. Thus, the rejection of claim 11 under Section 102(e) is not supported by the cited art and should be withdrawn since the Chen process does not disclose the Appellants' invention as set forth in claim 11 either directly or inherently.

A.12) Claim 12:

Claim 12 depends indirectly from claim 5 and directly from claim 9 and includes the additional limitation as set forth above for claim 9 and further the limitation of forming a magnetic field to confine the argon ions in a region proximate the target.

The arguments presented above with respect to the patentability of claims 5 and 9 apply to the patentability of claim 12 depending therefrom. Further claim 12 includes the additional limitation set forth above. Thus, the rejection of claim 12 under Section 102(e) is not supported by the cited art and should be withdrawn since the Chen process does not disclose the Appellants' invention as set forth in claim 12 either directly or inherently.

A.13) Claim 14:

Claim 14 depends indirectly from claim 5 and directly from claim 13 and includes the additional limitation of claim 13 of forming the plasma further comprises providing radio frequency power to a coil positioned between the target and the wafer, and wherein the target material particles pass through the coil, and the additional limitation of claim 14 of increasing the radio frequency power to increase a number of ionized target material particles..

The arguments presented above with respect to the patentability of claim 5 apply to the patentability of claim 14 depending therefrom. Further claim 14 includes the additional limitation set forth above. Thus, the rejection of claim 14 under Section 102(e) is not supported by the cited art and should be withdrawn since the Chen process does not disclose the Appellants' invention as set forth in claim 14 either directly or inherently.

A.14) Claim 15:

Claim 15 depends directly from claim 5 and includes the additional limitation of the material is deposited on a bottom surface of the plurality of openings.

The arguments presented above with respect to the patentability of claim 5 apply to the patentability of claim 15 depending therefrom. Further claim 15 includes the additional limitation set forth above. Thus, the rejection of claim 15 under Section 102(e) is not supported by the cited art and should be withdrawn since the Chen process does not disclose the Appellants' invention as set forth in claim 15 either directly or inherently.

A.15) Claim 16:

Claim 16 depends directly from claim 5 and includes the additional limitation of one or more of the plurality of openings comprise high aspect ratio openings.

The arguments presented above with respect to the patentability of claim 5 apply to the patentability of claim 16 depending therefrom. Further claim 16 includes the additional limitation set forth above. Thus, the rejection of claim 16 under Section 102(e) is not supported by the cited art and should be withdrawn since the Chen process does not disclose the Appellants' invention as set forth in claim 16 either directly or inherently.

A.16) Claim 18:

Claim 18 depends directly from claim 5 and includes the additional limitation of supplying power to the wafer further comprises supplying radio frequency power to the wafer.

The arguments presented above with respect to the patentability of claim 5 apply to the patentability of claim 18 depending therefrom. Further claim 18 includes the additional limitation set forth above. Thus, the rejection of claim 18 under Section 102(e) is not supported by the cited art and should be withdrawn since the Chen process does not disclose the Appellants' invention as set forth in claim 18 either directly or inherently.

A.17) Claim 25:

Independent claim 25 is directed to an apparatus for depositing material on a substrate having a plurality of openings formed therein.

The test for establishing a *prima facie* case of anticipation under §102 "requires the presence in a single prior art reference of each and every element of the claimed invention, arranged as in the claim." (*Lindemann Maschinenfabrik GMbH v. American Hoist and Derrick Co.*, 730 F.2d 1452, 221 USPQ 481,485 (Fed. Cir. 1984)). Furthermore, "there must be no difference between the claimed invention and the referenced disclosure, as viewed by a person of ordinary skill in the field of the invention." *Scripps Clinic and Research Found. v. Genentech Inc.*, 927 F.2d 1565, 18 USPQ2d 1001, 1010 (Fed. Cir. 1991)). The absence from the reference disclosure of any claim element and/or operational interrelationship negates anticipation under §102.

In the Examiner's rejection of claim 25, the Examiner specifically references Chen's Table 1 to support the Examiner's argument that the Appellants' controlling power step of claim 1 is disclosed. The Examiner further states that the patent laws do not require patent applicants to disclose every underlying scientific principle, feature or problem avoided.

Table 1 discloses process conditions for a two step process. In step one "the IMP chamber is being operated in a wafer pre-clean mode" with a target power of 0 kW. In step two the chamber is being operated "in an ionized sputter deposition mode" with a target power of 1 kW.

Chen discloses a process for, "removing a barrier layer formed at the bottom of a via by a sputter etching process performed in a plasma sputter deposition chamber [step 1]. The same sputter deposition chamber may be advantageously used to then deposit a second barrier layer [step 2]." The two steps of sputtering the wafer to remove the barrier layer and the sputtering step to deposit the second barrier layer are, "differentiated by power applied to the target, by chamber pressure, or by wafer bias." Chen further states at column 4, beginning at line 64, "[in step 1] the IMP chamber allows the formation of an argon plasma without sputtering the tantalum target by exciting the plasma through the inductive coil and not significantly DC biasing the target. The highly directional high-energy argon ions

incident on the wafer remove or sputter the CVD barrier bottom and field portions 32, 36. That is, a sputtering process is performed on the wafer, not a sputter deposition process."

The Chen process is further described by the parameters set forth in Table 1. These values are far below that required to "control[ling] power supplied to the target to maintain the wafer temperature below a critical temperature, wherein at a wafer temperature above the critical temperature the material of the first material layer can extrude into one or more of the plurality of openings."

Further, the Appellant's claim 25 element "a controllable power source connected to the target, wherein the power delivered by the power source is controlled to maintain the wafer temperature below a critical temperature during the deposition process" is materially different and patentably distinct from Chen's process of increasing the power level from a first value during a process pre-clean step to a second value during a sputter deposition step.

In his final Office Action, the Examiner advises that it is his duty to interpret the claims as broadly as reasonably possible, citing, *In re Pratter*, 415 F.2d 1393, 1404-05, 162 USPQ 541, 550-51 (CCPA 1969), *In re Morris*, 127 F.3d 1048, 1054-55, 44 USPQ2d 1023, 1027-28 (Fed. Cir. 1997), and *In re Zletz*, 13 USPQ 2d. 1320 (Fed. Cir. 1989). The Appellants suggest, however, that broad claim interpretation during the examination process is not a substitute for applying relevant art that discloses or renders obvious an invention as set forth in a patent claim.

The fact that a certain result or characteristic may occur or be present in the prior art, such as Chen, is not sufficient to establish the inherency of that result or characteristic. *In re Rijckaert*, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993). In this case the CAFC reversed the Examiner's rejection because inherency was based on what would result due to optimization of conditions, not what was necessarily present in the prior art.

"To establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.' "*In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999).

The Examiner has not met his burden of showing that Chen inherently discloses the Appellants' invention as set forth in claim 25. The Examiner cannot merely suggest that certain conditions within the ambit of the Appellants' claim 25 are inherent in Chen and thus Chen anticipates claim 25. To suggest anticipation on that basis requires one to read more into the Chen reference than it discloses, either directly or inherently.

Thus the rejection of claim 25 under Section 102(e) is not supported by the cited art and should be withdrawn since the Chen process does not disclose the Appellants' invention as set forth in claim 1 either directly or inherently.

A.18) Claim 26:

Claim 26 depends directly from claim 25 and includes the additional limitation of the power delivered by the power source is controlled to increase the deposition rate of target material on the substrate.

The arguments presented above with respect to the patentability of claim 25 apply to the patentability of claim 26 depending therefrom. Further claim 26 includes the additional limitation set forth above. Thus, the rejection of claim 26 under Section 102(e) is not supported by the cited art and should be withdrawn since the Chen process does not disclose the Appellants' invention as set forth in claim 26 either directly or inherently.

A.19) Claim 27:

Claim 27 depends directly from claim 25 and includes the additional limitation of the target material comprises titanium or tantalum.

The arguments presented above with respect to the patentability of claim 25 apply to the patentability of claim 27 depending therefrom. Further claim 27 includes the additional limitation set forth above. Thus, the rejection of claim 27 under Section 102(e) is not supported by the cited art and should be withdrawn since the Chen process does not disclose the Appellants' invention as set forth in claim 27 either directly or inherently.

A.20) Claim 28:

Claim 28 depends directly from claim 25 and includes the additional limitation of one or more of the plurality of openings comprise high aspect ratio openings.

The arguments presented above with respect to the patentability of claim 25 apply to the patentability of claim 28 depending therefrom. Further claim 28 includes the additional limitation set forth above. Thus, the rejection of claim 28 under Section 102(e) is not supported by the cited art and should be withdrawn since the Chen process does not disclose the Appellants' invention as set forth in claim 28 either directly or inherently.

B) The Appellants traverse the rejection of claims 19-24 as unpatentable under 35 U.S.C. 102(b) as anticipated by Gopalraja (U.S. 6,193,855 B1).

Gopalraja does not support a *prima facie* case of anticipation for claims 19-24 because the reference fails to teach each of the claimed elements.

With regard to rejections applied against claims 19-24, these rejected claims do not stand or fall together because each claim defines a unique combination that patentably distinguishes over the art of record and each should therefore be separately considered.

B.1) Claim 19:

Independent claim 19 is directed to a method for controlling a physical vapor deposition process.

The test for establishing a *prima facie* case of anticipation under §102 "requires the presence in a single prior art reference of each and every element of the claimed invention, arranged as in the claim." (*Lindemann Maschinenfabrik GMbH v. American Hoist and Derrick Co.*, 730 F.2d 1452, 221 USPQ 481,485 (Fed. Cir. 1984)). Furthermore, "there must be no difference between the claimed invention and the referenced disclosure, as viewed by a person of ordinary skill in the field of the invention." *Scripps Clinic and Research Found. v. Genentech Inc*, 927 F.2d 1565, 18 USPQ2d 1001, 1010 (Fed. Cir. 1991)). The absence of any claim element and/or operational interrelationship from the reference disclosure negates anticipation under §102.

Gopalraja discloses a technique related to the problem of material re-sputtering. "During a period of plasma decay, a bias to a substrate support member is increased to a relatively higher power, thereby periodically enhancing the attraction of positively charged particles to the substrate during the afterglow period of the plasma. The plasma decay is achieved by terminating the coupling of energy into the gases. In one embodiment, a bias to the target is also modulated." (See Column 3, beginning at line 12). Gopalraja's stated objective is to achieve conformal step coverage.

It is respectfully suggested that Gopalraja does not disclose or suggest the Appellants' invention as set forth in claim 19 as at least the Appellant's steps in claim 19 of "forming an electric field in a region of the target" and "controlling the electric field to maintain the wafer temperature below a critical temperature, above which the wafer can sustain damage" are not disclosed in the Gopalraja patent. It is therefore submitted that the Appellants' invention as described by independent claim 19 is patentably distinct from the disclosure of Gopalraja.

Thus the rejection of claim 19 under Section 102(b) is not supported by the cited art and should be withdrawn since the Gopalraja reference does not disclose the Appellants' invention as set forth in claim 19.

B.2) Claim 20:

Claim 20 depends directly from claim 19 and includes the additional limitation of the step of forming the electric field further comprises controlling the electric field to increase the velocity of the particles directed toward the target to effect an increase in an amount of sputtered target material.

The arguments presented above with respect to the patentability of claim 19 apply to the patentability of claim 20 depending therefrom. Further claim 20 includes the additional limitation set forth above. Thus the rejection of claim 20 under Section 102(b) is not supported by the cited art and should be withdrawn since the Gopalraja reference does not disclose the Appellants' invention as set forth in claim 20.

B.3) Claim 21:

Claim 21 depends directly from claim 19 and includes the additional limitation of the step of directing particles further comprises introducing argon molecules, ionizing the argon molecules to form a plasma of argon ions in a region of the target, and attracting the argon plasma to the target.

The arguments presented above with respect to the patentability of claim 19 apply to the patentability of claim 21 depending therefrom. Further claim 21 includes the additional limitation set forth above. Thus the rejection of claim 21 under Section 102(b) is not supported by the cited art and should be withdrawn since the Gopalraja reference does not disclose the Appellants' invention as set forth in claim 21.

B.4) Claim 22:

Claim 22 depends directly from claim 19 and includes the additional limitation of the step of forming the electric field further comprises controlling the electric field to increase an amount of sputtered target material.

The arguments presented above with respect to the patentability of claim 19 apply to the patentability of claim 22 depending therefrom. Further claim 22 includes the additional limitation set forth above. Thus the rejection of claim 22 under Section 102(b) is not supported by the cited art and should be withdrawn since the Gopalraja reference does not disclose the Appellants' invention as set forth in claim 22.

B.5) Claim 23:

Claim 23 depends directly from claim 19 and includes the additional limitation of the step of forming the electric field further comprises controlling the electric field to increase a rate at which ionized target material is deposited on the wafer.

The arguments presented above with respect to the patentability of claim 19 apply to the patentability of claim 23 depending therefrom. Further claim 23 includes the additional limitation set forth above. Thus the rejection of claim 23 under Section 102(b) is not supported by the cited art and should be withdrawn since the Gopalraja reference does not disclose the Appellants' invention as set forth in claim 23.

B.6) Claim 24:

Claim 24 depends directly from claim 19 and includes the additional limitation of the step of forming the electric field further comprises controlling the electric field to reduce the wafer temperature during the step of depositing the ionized target material on the wafer.

The arguments presented above with respect to the patentability of claim 19 apply to the patentability of claim 24 depending therefrom. Further claim 24 includes the additional limitation set forth above. Thus the rejection of claim 24 under Section 102(b) is not supported by the cited art and should be withdrawn since the Gopalraja reference does not disclose the Appellants' invention as set forth in claim 24.

C) The Appellants traverse the rejection of claims 13, 17, 29 and 30 as being unpatentable under 35 U.S.C. 103(a) over Chen as applied to claims 1-12, 14-16, 18 and 25-28 above and further in view of Gopalraja.

The cited prior art patents to Chen and Gopalraja do not render claims 13, 17, 29 and 30 *prima facie* obvious because there is no motivation to combine the references in the manner suggested by the Examiner to arrive at the claimed invention. MPEP 2143.01 provides that the mere fact that references can be combined or modified in hindsight does not render the resulting combination obvious. Rather, the prior art must also suggest the desirability of the combination (*In Re: Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990)).

With regard to the rejections applied against claims 13, 17, 29 and 30, these rejected claims do not stand or fall together because each claim defines a unique combination that patentably distinguishes over the art of record and each claim should therefore be separately considered

C.1) Claim 13:

Claim 13 depends directly from independent claim 5 and includes the additional limitation of a step of forming the plasma further comprising providing radio frequency

power to a coil positioned between the target and the wafer, and wherein the target material particles pass through the coil.

The arguments presented above with respect to the patentability of claim 5 apply to the patentability of claim 13 depending therefrom. Further claim 13 includes the additional limitation set forth above. Thus the rejection of claim 13 under Section 103(a) is not supported by the cited art since the reference combination of Chen and Gopalraja does not render obvious the Appellants' invention as set forth in claim 13.

Further, the Appellants argue that the cited prior art patents to Chen and Gopalraja do not render claim 13 *prima facie* obvious because there is no motivation to combine the references in the manner suggested by the Examiner to arrive at the claimed invention.

When a rejection depends on a combination of prior art references, there must be some teaching, suggestion, or motivation to combine the references. *In re Geiger*, 815 F.2d 686, 688 (Fed. Cir. 1987). Although the suggestion to combine references may flow from the nature of the problem, *Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc.*, 75 F.3d 1568, 1573 (Fed. Cir. 1996), the suggestion more often comes from the teachings of the pertinent references, *In re Sernaker*, 702 F.2d 989, 994 (Fed. Cir. 1983), or from the ordinary knowledge of those skilled in the art that certain references are of special importance in a particular field, Pro-Mold, 75 F.3d at 1573 (citing *Ashland Oil, Inc. v. Delta Resins &* Refractories, Inc., 776 F.2d 281, 297 n.24 (Fed. Cir. 1985)).

There is no suggestion or motivation to combine the disclosures of Chen and Gopalraja present in either of the references, nor is such a suggestion or motivation present in the ordinary knowledge of one skilled in the art. The Examiner states only the conclusion that, "it would have been obvious to a person of ordinary skill in the art at the time the invention was made to recognize that combining Gopalraja's process with Chen's invention would have been beneficial because the invention achieves good bottom coverage."

The references teach away from a combination because the parameters of Chen's two-step process (barrier layer removal step one and sputter deposition step two) are fixed values as set forth in Table 1. Gopalraja discloses modulating the various parameters during his deposition process. See Gopalraja's Abstract lines 10 and 11 where he discloses increasing a substrate bias during a period of plasma decay; column 3, lines 18 and 19 where

he discloses modulating a bias to the target and column 3, lines 29-39 where he discloses on/off modulating a coil power and the substrate bias.

Furthermore, when determining the patentability of a claimed invention which combines two elements, "the question is whether there is something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination." *In re Beattie*, 974 F.2d 1309, 1311-12 (Fed. Cir. 1992) (quoting *Lindemann Maschinenfabrik GMBH v. Am. Hoist & Derrick Co.*, 730 F.2d 1452, 1462 (Fed. Cir. 1984)). An invention will not be rendered obvious merely by combining teachings found in the prior art. There must be some suggestion or incentive in the prior art to make the combination. The prior art must suggest that the combination would have a reasonable likelihood of success. *In re Bolduc*, 1992 U.S. App. LEXIS 2480 (Fed. Cir., 1992).

The Appellants are aware of no prior art that suggests a reasonable likelihood of success associated with the combination of the Chen and Gopalraja references.

Thus the rejection of claim 13 under Section 103(a) is not supported by the cited art and should be withdrawn since the combination of the prior art patents to Chen and Gopalraja do not disclose or render obvious claim 13.

C.2) Claim 17:

Claim 17 depends directly from independent claim 5 and further includes the limitation of wherein the step of supplying power to the target further comprises supplying power to the target to increase an intensity of an electric field formed by the power supply to the target.

The arguments presented above with respect to the patentability of claim 5 apply to the patentability of claim 17 depending therefrom. Further claim 17 includes the additional limitation set forth above. Thus the rejection of claim 17 under Section 103(a) is not supported by the cited art since the reference combination of Chen and Gopalraja does not render obvious the Appellants' invention as set forth in claim 17.

Further, the Appellants argue that the cited prior art patents to Chen and Gopalraja do not render claim 17 *prima facie* obvious because there is no motivation to combine the references in the manner suggested by the Examiner to arrive at the claimed invention.

When a rejection depends on a combination of prior art references, there must be some teaching, suggestion, or motivation to combine the references. *In re Geiger*, 815 F.2d 686, 688 (Fed. Cir. 1987). Although the suggestion to combine references may flow from the nature of the problem, *Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc.*, 75 F.3d 1568, 1573 (Fed. Cir. 1996), the suggestion more often comes from the teachings of the pertinent references, *In re Sernaker*, 702 F.2d 989, 994 (Fed. Cir. 1983), or from the ordinary knowledge of those skilled in the art that certain references are of special importance in a particular field, Pro-Mold, 75 F.3d at 1573 (citing *Ashland Oil, Inc. v. Delta Resins & Refractories, Inc.*, 776 F.2d 281, 297 n.24 (Fed. Cir. 1985)).

There is no suggestion or motivation to combine the disclosures of Chen and Gopalraja present in either of the references, nor is such a suggestion or motivation present in the ordinary knowledge of one skilled in the art. The Examiner states only the conclusion that, "it would have been obvious to a person of ordinary skill in the art at the time the invention was made to recognize that combining Gopalraja's process with Chen's invention would have been beneficial because the invention achieves good bottom coverage."

The references teach away from a combination because the parameters of Chen's two-step process (barrier layer removal step one and sputter deposition step two) are fixed values as set forth in Table 1. Gopalraja discloses modulating the various parameters during his deposition process. See Gopalraja's Abstract lines 10 and 11 where he discloses increasing a substrate bias during a period of plasma decay; column 3, lines 18 and 19 where he discloses modulating a bias to the target and column 3, lines 29-39 where he discloses on/off modulating a coil power and the substrate bias.

Furthermore, when determining the patentability of a claimed invention which combines two elements, "the question is whether there is something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination." *In re Beattie*, 974 F.2d 1309, 1311-12 (Fed. Cir. 1992) (quoting *Lindemann Maschinenfabrik GMBH v. Am. Hoist & Derrick Co.*, 730 F.2d 1452, 1462 (Fed. Cir. 1984)). An invention will not be rendered obvious merely by combining teachings found in the prior art. There must be some suggestion or incentive in the prior art to make the combination. The prior art must

suggest that the combination would have a reasonable likelihood of success. *In re Bolduc*, 1992 U.S. App. LEXIS 2480 (Fed. Cir., 1992).

The Appellants are aware of no prior art that suggests a reasonable likelihood of success associated with the combination of the Chen and Gopalraja references.

Thus the rejection of claim 17 under Section 103(a) is not supported by the cited art and should be withdrawn since the combination of the prior art patents to Chen and Gopalraja do not render obvious claim 17.

C.3) Claim 29:

Claim 29 depends directly from independent claim 25 and further includes the additional limitation of a coil disposed between the wafer chuck and the target for forming a target material plasma and a radio frequency power source connected to the coil, wherein the target material plasma is formed as the target material passes through the coil.

The arguments presented above with respect to the patentability of claim 25 apply to the patentability of claim 29 depending therefrom. Further claim 29 includes the additional limitation set forth above. Thus the rejection of claim 29 under Section 103(a) is not supported by the cited art since the reference combination of Chen and Gopalraja does not render obvious the Appellants' invention as set forth in claim 29.

Further, the Appellants argue that the cited prior art patents to Chen and Gopalraja do not render claim 29 *prima facie* obvious because there is no motivation to combine the references in the manner suggested by the Examiner to arrive at the claimed invention.

When a rejection depends on a combination of prior art references, there must be some teaching, suggestion, or motivation to combine the references. *In re Geiger*, 815 F.2d 686, 688 (Fed. Cir. 1987). Although the suggestion to combine references may flow from the nature of the problem, *Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc.*, 75 F.3d 1568, 1573 (Fed. Cir. 1996), the suggestion more often comes from the teachings of the pertinent references, *In re Sernaker*, 702 F.2d 989, 994 (Fed. Cir. 1983), or from the ordinary knowledge of those skilled in the art that certain references are of special importance in a particular field, Pro-Mold, 75 F.3d at 1573 (citing *Ashland Oil, Inc. v. Delta Resins & Refractories, Inc.*, 776 F.2d 281, 297 n.24 (Fed. Cir. 1985)).

There is no suggestion or motivation to combine the disclosures of Chen and Gopalraja present in either of the references, nor is such a suggestion or motivation present in the ordinary knowledge of one skilled in the art. The Examiner states only the conclusion that, "it would have been obvious to a person of ordinary skill in the art at the time the invention was made to recognize that combining Gopalraja's process with Chen's invention would have been beneficial because the invention achieves good bottom coverage."

The references teach away from a combination because the parameters of Chen's two-step process (barrier layer removal step one and sputter deposition step two) are fixed values as set forth in Table 1. Gopalraja discloses modulating the various parameters during his deposition process. See Gopalraja's Abstract lines 10 and 11 where he discloses increasing a substrate bias during a period of plasma decay; column 3, lines 18 and 19 where he discloses modulating a bias to the target and column 3, lines 29-39 where he discloses on/off modulating a coil power and the substrate bias.

Furthermore, when determining the patentability of a claimed invention which combines two elements, "the question is whether there is something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination." *In re Beattie*, 974 F.2d 1309, 1311-12 (Fed. Cir. 1992) (quoting *Lindemann Maschinenfabrik GMBH v. Am. Hoist & Derrick Co.*, 730 F.2d 1452, 1462 (Fed. Cir. 1984)). An invention will not be rendered obvious merely by combining teachings found in the prior art. There must be some suggestion or incentive in the prior art to make the combination. The prior art must suggest that the combination would have a reasonable likelihood of success. *In re Bolduc*, 1992 U.S. App. LEXIS 2480 (Fed. Cir., 1992).

The Appellants are aware of no prior art that suggests a reasonable likelihood of success associated with the combination of the Chen and Gopalraja references.

Thus the rejection of claim 29 under Section 103(a) is not supported by the cited art and should be withdrawn since the combination of the prior art patents to Chen and Gopalraja do not render obvious claim 29.

C.4) Claim 30:

Claim 30 depends indirectly from claim 25 and directly from claim 29 and includes the additional limitation of a power source for biasing the wafer to attract the target material plasma to the wafer.

The arguments presented above with respect to the patentability of claim 25 and apply to the patentability of claim 30 depending therefrom. Further claim 30 includes the additional limitation set forth above. Thus the rejection of claim 30 under Section 103(a) is not supported by the cited art since the reference combination of Chen and Gopalraja does not render obvious the Appellants' invention as set forth in claim 30.

Further, the Appellants argue that the cited prior art patents to Chen and Gopalraja do not render claim 30 *prima facie* obvious because there is no motivation to combine the references in the manner suggested by the Examiner to arrive at the claimed invention.

When a rejection depends on a combination of prior art references, there must be some teaching, suggestion, or motivation to combine the references. *In re Geiger*, 815 F.2d 686, 688 (Fed. Cir. 1987). Although the suggestion to combine references may flow from the nature of the problem, *Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc.*, 75 F.3d 1568, 1573 (Fed. Cir. 1996), the suggestion more often comes from the teachings of the pertinent references, *In re Sernaker*, 702 F.2d 989, 994 (Fed. Cir. 1983), or from the ordinary knowledge of those skilled in the art that certain references are of special importance in a particular field, Pro-Mold, 75 F.3d at 1573 (citing *Ashland Oil, Inc. v. Delta Resins & Refractories, Inc.*, 776 F.2d 281, 297 n.24 (Fed. Cir. 1985)).

There is no suggestion or motivation to combine the disclosures of Chen and Gopalraja present in either of the references, nor is such a suggestion or motivation present in the ordinary knowledge of one skilled in the art. The Examiner states only the conclusion that, "it would have been obvious to a person of ordinary skill in the art at the time the invention was made to recognize that combining Gopalraja's process with Chen's invention would have been beneficial because the invention achieves good bottom coverage."

The references teach away from a combination because the parameters of Chen's two-step process (barrier layer removal step one and sputter deposition step two) are fixed values as set forth in Table 1. Gopalraja discloses modulating the various parameters during

his deposition process. See Gopalraja's Abstract lines 10 and 11 where he discloses increasing a substrate bias during a period of plasma decay; column 3, lines 18 and 19 where he discloses modulating a bias to the target and column 3, lines 29-39 where he discloses on/off modulating a coil power and the substrate bias.

Furthermore, when determining the patentability of a claimed invention which combines two elements, "the question is whether there is something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination." *In re Beattie*, 974 F.2d 1309, 1311-12 (Fed. Cir. 1992) (quoting *Lindemann Maschinenfabrik GMBH v. Am. Hoist & Derrick Co.*, 730 F.2d 1452, 1462 (Fed. Cir. 1984)). An invention will not be rendered obvious merely by combining teachings found in the prior art. There must be some suggestion or incentive in the prior art to make the combination. The prior art must suggest that the combination would have a reasonable likelihood of success. *In re Bolduc*, 1992 U.S. App. LEXIS 2480 (Fed. Cir., 1992).

The Appellants are aware of no prior art that suggests a reasonable likelihood of success associated with the combination of the Chen and Gopalraja references.

Thus the rejection of claim 30 under Section 103(a) is not supported by the cited art and should be withdrawn since the combination of the prior art patents to Chen and Gopalraja do not render obvious claim 30.

Respectfully submitted,

John L. DeAngelis, Jr.
Beusse Brownlee Wolter Mora & Maire, P.A.
390 North Orange Ave., Suite 2500
Orlando, FL 32801
Telephone: (407) 926-7710

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CLAIMS APPENDIX

37 CFR 41.37(c)(1)(viii)

1. A method for depositing a target material on a semiconductor wafer, wherein the wafer comprises a first material layer, an overlying second material layer and a plurality of openings in the second material layer extending to the first material layer, the method comprising:

sputtering target material particles from a target;

controlling power supplied to the target to maintain the wafer temperature below a critical temperature, wherein at a wafer temperature above the critical temperature the material of the first material layer can extrude into one or more of the plurality of openings; and

depositing the target material particles on the wafer.

2. The method of claim 1 wherein the step of controlling power supplied to the target further comprises increasing the power supplied to the target to increase a deposition rate of target material particles on the wafer above a deposition rate at which the first material layer can extrude into one or more of the plurality of openings.

3. The method of claim 1 wherein the material comprising the target is selected from between titanium and tantalum.

4. The method of claim 1 wherein one or more of the plurality of openings comprise high aspect ratio openings.

5. A method for depositing a target material on a semiconductor wafer, wherein the wafer comprises a first material layer, an overlying second material layer and a plurality of openings in the second material layer extending to the first material layer, the method comprising:

providing a target comprising the target material;

supplying power to the target to maintain the wafer temperature below a critical temperature, wherein at a wafer temperature above the critical temperature the material of the first material layer can extrude into the plurality of openings;

positioning the wafer below the target;

sputtering target material particles in response to impinging particles directed toward the target;

forming a plasma of ionized target material particles from the sputtered target material particles between the target and the wafer;

supplying power to the wafer to attract the ionized target material particles to the wafer; and

depositing the ionized target material particles on the wafer.

6. The method of claim 5 wherein the step of supplying power to the target further comprises increasing the power supplied to the target to increase a deposition rate of ionized target material particles on the wafer, above a deposition rate at which the first material layer can extrude into the plurality of openings.

7. The method of claim 5 wherein the step of supplying power to the target further comprises increasing the power supplied to the target to increase a density of the impinging particles.

8. The method of claim 5 wherein the material comprising the target is selected from between titanium and tantalum.

9. The method of claim 5 wherein the particles impinging the target comprise argon ions.

10. The method of claim 9 wherein the step of supplying power to the target further comprises increasing the power supplied to the target to increase a velocity of the argon ions.

11. The method of claim 9 wherein the step of supplying power to the target further comprises increasing the power supplied to the target to increase a density of the argon ions.

12. The method of claim 9 further comprising forming a magnetic field to confine the argon ions in a region proximate the target.

13. The method of claim 5 wherein the step of forming the plasma further comprises providing radio frequency power to a coil positioned between the target and the wafer, and wherein the target material particles pass through the coil.

14. The method of claim 13 further comprising increasing the radio frequency power to increase a number of ionized target material particles.

15. The method of claim 5 wherein the material is deposited on a bottom surface of the plurality of openings.

16. The method of claim 5 wherein one or more of the plurality of openings comprise high aspect ratio openings.

17. The method of claim 5 wherein the step of supplying power to the target further comprises supplying power to the target to increase an intensity of an electric field formed by the power supplied to the target.

18. The method of claim 5 wherein the step of supplying power to the wafer further comprises supplying radio frequency power to the wafer.

19. A method for controlling a physical vapor deposition process for depositing material from a target onto a semiconductor wafer comprising a plurality of features and positioned below the target, the method comprising:

forming an electric field in a region of the target;

directing particles toward the target;

sputtering target material from the target in response to the particles;

forming a plasma between the target and the wafer, wherein the sputtered target material is ionized by the plasma to form ionized target material;

supplying radio frequency power to the wafer for attracting the ionized target material to the wafer;

depositing the ionized target material on the wafer; and

controlling the electric field to maintain the wafer temperature below a critical temperature, above which wafer features can sustain damage.

20. The method of claim 19 wherein the step of forming the electric field further comprises controlling the electric field to increase the velocity of the particles directed toward the target to effect an increase in an amount of sputtered target material.

21. The method of claim 19 wherein the step of directing particles further comprises introducing argon molecules, ionizing the argon molecules to form a plasma of argon ions in a region of the target, and attracting the argon plasma to the target.

22. The method of claim 19 wherein the step of forming the electric field further comprises controlling the electric field to increase an amount of sputtered target material.

23. The method of claim 19 wherein the step of forming the electric field further comprises controlling the electric field to increase a rate at which ionized target material is deposited on the wafer.

24. The method of claim 19 wherein the step of forming the electric field further comprises controlling the electric field to reduce the wafer temperature during the step of depositing the ionized target material on the wafer.

25. An apparatus for depositing material on a substrate having a plurality of openings formed therein, the apparatus comprising:

a target formed from the material to be deposited on the substrate;

a source of impinging particles directed toward the target, wherein target material is released from the target in response to the impinging particles, wherein the released target material is deposited on the substrate;

a controllable power source connected to the target, wherein the power delivered by the power source is controlled to maintain the wafer temperature below a critical temperature during the deposition process; and

a wafer chuck for supporting the wafer during the deposition process.

26. The apparatus of claim 25 wherein the power delivered by the power source is controlled to increase the deposition rate of target material on the substrate.

27. The apparatus of claim 25 wherein the target material comprises titanium or tantalum.

28. The apparatus of claim 25 wherein one or more of the plurality of openings comprise high aspect ratio openings.

29. The apparatus of claim 25 further comprising a coil disposed between the wafer chuck and the target for forming a target material plasma and a radio frequency power source connected to the coil, wherein the target material plasma is formed as the target material passes through the coil.

30. The apparatus of claim 29 further comprising a power source for biasing the wafer to attract the target material plasma to the wafer.

end

EVIDENCE APPENDIX

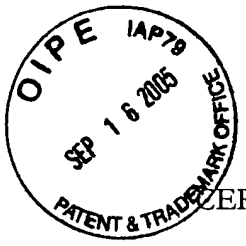
37 CFR 41.37(c)(1)(xi)

NONE.

RELATED PROCEEDINGS APPENDIX

37 CFR 41.37(c)(1)(x)

NONE.



CERTIFICATE OF MAILING

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Pamela A. Pagel